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## MODSSO – A Manager-centric Global Decision Support System for Organizations

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### Abstract

The goal of this paper is to describe a set of structured concepts for the design of software systems supporting the global decision process in an enterprise or organization.

The concepts has as elements: i) each manager has available a decision dashboard to support, in a framework of decision theory, the flux of decision-making for which he or she is responsible; ii) the dashboards also allow managers crowdsourcing from non-managers different aspects of decision iii) the dashboards are connected in a conversational network; iv) this conversational network is so structured to support the global decision process of the organization.

An example of implementation's architecture for the concept will be described.

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## 1. Introduction

The work presented in this paper is based on the concept of a conversational decision support system for organizations, described in [1-3]. Here we shape the concept in a more immediately applicable form, with strong emphasis of the system design on usability and use by managers. We also describe an example of implementation architecture.

The concept of a conversational decision support system acknowledges the fundamental role of conversations among people in decision processes. Inside an organization, decisions can be taken, first, by automatic devices, as some management software that implements established rules upon data. Second, they can be taken in an individual fashion by managers. These modes of decision taking making no use of conversation have their usefulness, but people's practice shows that, usually, from some level up of decision difficulty, conversations among people are necessary for good decisions, if not only for decisions.

This leads one to think of the set of decisions taken in an organization as being supported first and foremost by a network of conversations, complemented with individual and automatic decision. Taken altogether along time the set of decisions can be seen as the global decision process of the organization. Therefore one can ask if and how decision support systems can be built that target to empower managers to accomplish better their managerial tasks in the frame of a global decision support system. It turns out that such system must have support for formalizing decision processes and support conversations. With regard to specific types of decisions, managers can possibly rely on specific decision support systems. Yet, to the best of our knowledge, the idea of a system to support the global decision process as such, that is, in its entirety, has not found its way into functioning products or systems. This was the theme of the above referred papers.

In this paper, we explore another dimension of the problem. As in the papers above, we depart from the concept that any organization or enterprise has, implicitly, a global decision process. This global decision process is constituted by all the decisions taken by managers at different responsibility levels and the interactions among people contributing to the taken decisions. This process has a fuzzy character and implies conversations among people [4].

To this we add another recognition of fact as a key concept. Managers are the ones that take decisions and assume responsibility for the decisions taken. In a successful organization managers are committed to bettering decisions and decision processes. It follows that managers are the ones assuming responsibility for the global decision process of an organization or enterprise. Unavoidably, they shape the process and the system should follow this shaping. Therefore, the architecture for the global decision support system deployed here is *manager centric*.

The main role of each manager is to originate a stream of decisions. Following a manager centric approach, the first function of a system supporting the global decision process must be, exactly, to support each and every manager in her or his daily managing activity, i.e. to support each manager in taking decisions.

In the presented approach, the interface between the global decision support system and each user will be called a decision dashboard. There are decision processes in the organization and people that participate in the decision processes. Processes, people, interactions among people and the system are to be registered in a database or a database system. Each system user, each manager, will have access to a personalized view of the database, as well as personalized functionalities, through his or her decision dashboard. The decision dashboard is deemed to become the main tool of managers in their daily managing tasks.

In the perspective of this paper, the network of dashboards and associated data base, or data bases, constitutes the global decision support system of the organization. Section 2 describes dashboards from the point of view of single manager usage. Section 3 describes communicating and joint-decision capabilities in the network of dashboards, leading to the envisaged global decision support system. In Section 4 we sketch a possible implementation approach. Section 5 concludes.

## 2. Decision dashboards

In the envisaged architecture, each manager or person participating in decision processes will have available a personalized decision dashboard allowing him or her to create or enter decision processes, to view the structure of decision processes assigned to him or her or for which she or he commits responsibility or cooperation, and to access and change the individual decision processes parameters, according to his or her status.

Taking a decision follows a process that one can characterize as a formal sequence of steps, where each step has a well defined function – even if the process is subjectively followed in an informal way. Formal characterizations of the decision process can be found in the classical works of Newel and Simon, 1972 [5] and Simon, 1976 [6], among others.

Therefore, it makes sense that the decision dashboard will supply, as a main functionality, a sequence of formalized steps for each decision process. The usefulness of following the formalized steps grows with the complexity of the decision to be made. Therefore, such functionality should allow for ‘jumping’ steps if the decision process is not worth the effort of following each and every step.

In formalizing a sequence of steps for decision one must take in account that a decision process does not end with decision taking. Capabilities to follow-up the execution of taken decisions are crucial.

For each decision process the system will provide a formalized flow. The following steps and states are an example of a formalized flow.

1. Issue raise: an issue is raised by stating that a given criterion is no more satisfied.
2. Issue acceptance: facing a raised issue, the manager can request from the issue originator (eventually him or herself) to better define the issue. If he or she finds that no gain can be obtained from trying a better definition then he or she can:
  - a) Dismiss it is invalid or a non-issue;
  - b) Keep it as an issue awaiting further decision;
  - c) Decide that the issue is accepted to become a new decision process.
3. Action listing: regarding the accepted issue a list of available actions, *A*, is assembled.
4. Option listing, satisfying and costing: on the basis of the available actions list *A*, a list of options *O* is made. Each option is a combination of actions. For each option, the expected evolution of the criterion is assessed. Options are generated till one is predicted to move the criterion to the satisfying value. Further options may be generated to test for possible lesser costs.
5. Decision-taking: an option is selected either as an individual decision or a collective decision. In setting up a criterion that is not purely scalar, preferences must be introduced as parameters. One can agree that a criterion has an unsatisfying (or satisfying) value and disagree on the values of preferences. This and the search for less costly options gives decision-making a non-trivial dimension, different from applying the first generated option that satisfies the criterion.
6. Monitoring decision implementation: define which feedbacks are expected at which time to assess decision success.
7. Archiving the process for further reference once it is considered complete.

Decision processes will result from requests or issues raised by someone and that must be served. Frequently, a decision process triggers another or several decision processes so that completion of a process depends on other processes completing. This is an important view of decision processes the system must provide as well as categorizing or tagging issues to support individual manager decision taking.

With regard to the set of decision processes a manager is handling, the decision dashboard must allow standard views of the set as listings by name, issue raise and acceptance dates, urgency, timelines, etc. Presentation methods other than listings can be envisaged as those depicting graphically to users the dependencies of decision processes or their structure.

### **3. Communication and joint decisions**

Managers do not work in a vacuum. Constantly, they talk among them both to the effect of trimming one's decisions and of taking collective decisions. Inputs for decisions are also generated through conversations with non-managers. One can deem the global decision process of an enterprise emerging as the coordination and interaction of the individual streams of activities of managers through communication and joint decision processes.

Therefore it makes sense that communication and joint decision capabilities be built in and among dashboards so that orders or decisions can be communicated, feedback can flow among managers, and joint decisions can be taken.

#### *3.1. Communication seen among individual managers*

Communication capabilities may be seen first as communication among individual managers. Let us suppose that an executive director issues a set of orders or decisions to the departments under his or her supervision. These must arrive at the decision dashboards of the department managers as accepted issues.

A decision from an upper level of management arriving at an immediate lower level manager can require from this one an effective decision process, or it can simply translate to taking an option implied by the decision. In this case, one could talk of a dummy decision process or order accomplishing. In any case, it can give rise to further requests either of decision to other managers or commands to non-managers.

This suggests that commands issued to non-managers, their following-up and feedback can be integrated into the system (see below reduced dashboards). Integration would give a manager of a given rank the capability to view the status of completion of any decision he or she has taken through access to the statuses of completion of all decisions and commands that his or her decision triggered. Such *map snapshots* of decision (and action) processes could encompass all the organization at the directors' board level. This partial or global mapping of decision processes appears immensely useful as allowing instant and recurrent feedback on the operation of the organization.

The type of feedback sketched in the last paragraph is valuable but should be complemented with deliberate feedback given by those in charge of implementing a decision. If an upper level manager miscalculates the effects or resources required by a decision, it is better for everybody that he or she knows it, rather than people trying to comply with an inefficient, distressful or disrupting task for the organization. Such situations can be avoided if lower level managers or non-managers are allowed to give feedback on a decision, detailing the difficulties of its implementation. This feedback can (or not) be taken to impart on the cost and satisfying analysis of options, leading to adjust or re-work the analysis and to adapt the decision taken in 'soft' or 'hard' ways. The system supports and establishes a circular flow of information with decisions going downhill the decision and responsibility hierarchy and feedback going uphill.

#### *3.2. Joint decisions*

Individual decision may solve effectively, efficiently and resiliently lots of issues. But, by the very nature of things one decides on in a human organization or enterprise, there are issues that require joint decision.

Joint decision may be necessary by questions of common commitment and responsibility, but their great power resides in cooperative decision.

Cooperative decision has two dimensions. Managers taking decisions establish adaptive loops in the organizational space impacted by their decisions. This organizational space has managers and non-managers; managers have all to gain from cooperation of other people to take decisions.

The first dimension of cooperative decision to consider is cooperation among managers. It may proceed informally or, formally, through joint decisions. Informal cooperation can happen when a manager invites or asks other managers to help in a decision process he or she is in charge. This can happen in a way such that cooperation becomes registered in the decision support system along some formalized steps (or not). In both cases, responsibility of the decision taken rests with the 'inviting' manager.

Joint decisions are exerted by joint decision groups. In a joint decision group all members are collectively responsible for decisions taken. If a manager belongs to a joint decision group, a number of her or his decisions are collective ones. A joint decision group needs a leader, but the role of the leader is not to shape decision at first place but to create the conditions for people to produce collectively good decisions.

The support to cooperative decision amounts, both in the formal and informal cases, to allowing shared access to decision processes. In informal cooperation the "owner" of the process invites other managers to join. In formal cooperation or joint decision groups, the group leader or head 'enrolls' the managers belonging to the group in the process.

Differently to informal cooperation, processes for joint decision groups require polling or voting mechanisms, to solve those cases where the group does not arrive to consensus.

### *3.3. 'Crowdsourcing' decision or the use of collective intelligence techniques*

Cooperation with non-managers can be conceived as 'crowdsourcing' decision. 'Crowdsourcing' has become a popular term for the use of collective intelligence techniques. Collective intelligence techniques explore the capabilities of groups for performing intelligence requiring tasks better than any member of the group can perform [7]. Collective intelligence was popularized by the book of Surowiecki [8], from which the term 'crowdsourcing' evolved meaning that an organization 'sources' something from a 'crowd'.

'Crowdsourcing' has become more and more recognized as a powerful technique to foster the success of organizations as the growing number of existing tools to profit from shows: Malone [9], IBM [10]. Understanding decision 'crowdsourcing' as backing decisions with collective intelligence techniques, inside the organization, begins with promoting and taking due care of non-managers inputs regarding decision-making. As referred above, managers taking decisions establish adaptive loops in the organizational space impacted by their decisions. A manager is the person in the loop that comes up with decisions regarding issues. The success of the loop very much depends on how people openly generate and pass information along.

In the framework proposed, a manager can 'crowdsource' decision announcing that, with respect to his or her domain of decision, non-managers can raise issues, selectively view processes, list actions and options and give feedback on decisions. In this way, his or her capabilities can be quite amplified assuming that the right conditions are given to people and people adhere to the process. The manager can detect the level of commitment to a decision – or lower his or her level of responsibility on the decision – by using polling or voting mechanisms. It remains its own decision to take the option preferred or chosen by a majority of voters.

Institutional joint decision processes are mandatory, informal and 'crowdsourcing' ones are optional, but, apart this, they share the same form in what respects involvement of people and the same dynamic process. Both are different from the single person decision process only on who can select symbols to be stored in

fields and in the process that leads from participants to decision being explicit. ‘Crowdsourcing’ can be supported by providing non-managers with decision dashboards adequately parameterized.

Collective processes, either institutional or ‘crowdsourced’, can be structured along with individual ones in maps that show their linkages up to the map of the global decision process of the organization.

#### 4. A model for implementation

The proposed system can be implemented based on a web server accessible via a web browser in a personal computer or mobile device. The system support for mobile devices is important because, with them, the decision dashboards can go easily into the operations field and support local micro-decisions. Additionally, the input from lower management levels can be collected as the action happens and is not delayed until the manager comes to office.

The system will provide the following features:

- User authentication
- Create and modify enterprise hierarchy relationship graph
- List, Create, Modify, Follow and Archive decisions
  - With names, descriptions, attachments, deadlines, priorities and upper level decisions
- Target decisions to lower level managers or implementers
- Add status, comments and critical notifications in implementations
- Request status update for a decision
- Personal dashboard with:
  - My decisions – decisions that a manager took and are addressed to lower levels
  - My implementations – decisions took by upper level management where the user feedback and status is needed
  - Overall status implementation for all decisions and implementations
  - Manager status on the decision (on time, delayed, critical, blocked)
  - Possibility to order the decisions in the dashboard by priority or deadline
  - List lower level decisions created to support a decision and get all the status

The system will be built around a database with the following data scheme, partially represented in Figure 1:

1. Users
  - a) UserID
  - b) UserPassword
  - c) UserPrivileges
2. EnterpriseGraph
  - a) UserID
  - b) UpperManagerUserID
3. Decisions
  - a) ID
  - b) CreationDate
  - c) Name
  - d) DescriptionOrIssue
  - e) ListOfActions
  - f) ListOfOptions

- g) DecisionTaken
  - h) Attachments
  - i) Deadline
  - j) Priority
  - k) ProcessStatus
  - l) Implementer
  - m) ImplementationStatus
  - n) LastUpdateDateTime
  - o) UpperLevelDecisionID
4. DecisionUpdates
- a) DecisionID
  - b) DateTime
  - c) UserID
  - d) UpdateType
  - e) UpdateValue
  - f) Comment

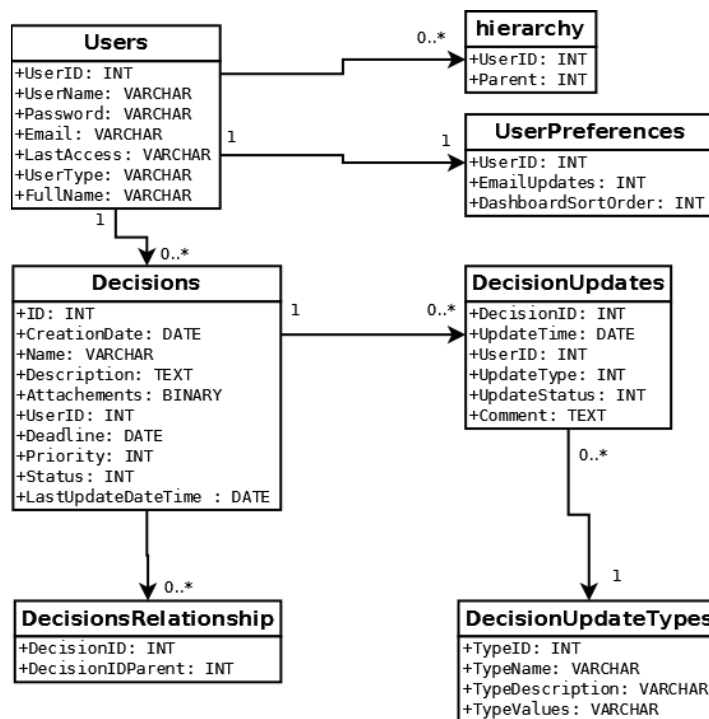


Fig. 1 Partial representation of the database scheme

The server housing the system can be accessible via internet or intranet. An open source implementation of the server could be made with the following components:

- A Linux distribution as Ubuntu
- The Apache web server



- The MySQL or PostgreSQL database
- An Web Language interpreter as PHP or Python

The authentication and user interaction will be performed through a web browser, and server side code will be responsible to collect and organize all the information in the server database. This architecture implementation has been tested in an ancestor system, to the being proposed, built to establish a proof of concept [11].

As a further improvement, custom applications can be made to serve mobile devices. This will enhance productivity and will allow one to take advantage of particular features of mobile devices as collecting photos or videos from field, collecting a voice note or even a device location for location aware decisions.

## 5. Conclusions and perspectives

A manager centric implementation model of decision support systems for the global decision process in an organization has been described. The model views managers as shaping this process and, therefore, gives to each one a *decision dashboard* creating a personalized interface of the manager with the system. Decision dashboards support several functions on decision processes including a formalization of the process.

Communicating decision dashboards allow to connect managers, to deploy cooperative and joint decision, and create visual maps of the global decision process, both partial and global.

The framework enables easy inclusion of collective intelligence techniques or ‘decision crowdsourcing’ into decision processes.

A prototype of a prior proof of concept exists. We aim to upgrade this prototype to a fully working version.

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